The Use of Stem Cells in Dental Implant Site Development

KAMAL KHAN HOTI1, MUHAMMAD MANSOOR AYUB2, IMRAN SALEEM QURESHI3, SAJID HUSSAIN4, SAHIBZADI FATIMA TARIO5, TAIMUR KHAN5, ALI HAMAD KHAN6, NOOR UL AMIN6
1-2Assistant Professor (Oral Pathology) Frontier Medical and Dental College, Abbottabad
3Assistant Professor, Department of Operative Dentistry, Frontier Medical & Dental College, Abbottabad
4Assistant Professor, Department of Science of Dental Materials, Abbottabad
5Senior Registrar, Oral Pathology, Rehman College of Dentistry, Abbottabad
6Associate professor orthodontics, FMDC, Abbottabad
7Lecturer Dental Material, Frontier Medical And Dental College, Abbottabad
8Consultant Periodontist, FMDC, Abbottabad
Correspondence to Dr. Kamal Khan Hoti, Assistant Professor

ABSTRACT

Aim: The use of stem cells in dental implant site development

Methods: A total of 15 patients were enrolled and divided into three groups, with each group receiving 1x10^5 1x10^6, and 1x10^7 stem cell treatment dosages. Following treatment, CT scan was done to measure their bone mineral density (BMD), which was scored using Hounsfield units (HU) grading. Tests were performed prior to treatment, as well as 4,6,8,12 weeks after dental implantation to determine the success of the procedure.

Results: There were no major side effects over the six-month study period. There was no association identified between the stem cell transplant and any of the side effects Multiplex immunological tests were used to determine the amount of cytokines and chemokines present in the subjects. The inflammatory markers eotaxin, FGF2, MCP-1, MDC, and IL17a were elevated in patients treated with stem cells. Stem cells secrete cytokines and chemokines that aid in the healing of damaged tissue.

Conclusions: Stem cell treatment for dental implantation is well tolerated and has no significant negative effects.

Keywords: Stem cell, dental implantation

INTRODUCTION

The success of dental implant surgery is highly dependent on the integrity of the surrounding bone. When teeth are extracted, guided bone regeneration (GBR) is a frequent procedure used to improve the osseointegration of the alveolar bone that surrounds the tooth extraction site. In addition to boosting osteogenesis and osteoconduction, the GBR treatment helps to stimulate bone formation by utilizing a barrier membrane to keep non-osteogenic tissue out of the treatment area.

The use of stem cells to increase GBR has also been promoted as a method of increasing GBR.

METHODOLOGY

As part of a "5 + 5 design," we used sequential cohorts in clinical trial to determine the appropriate sample size for analysis. A "5 +5 design," to put it simply, entails enrolling five patients at a low dose at the start of the research. In order to establish the safety profile, a total of 15 patients had to be included. A low dose (1x10^5 CD61Lin cells/0.25 ml) was administered to the first five patients; a medium dose (1x10^6 CD61Lin cells/0.25 ml DPBS) to other five patients; and a high dose (1x10^7 CD61Lin cells/0.25 ml DPBS) to the last five patients. BMD was measured every week for 24 weeks during this study. Hard tissue examinations were performed weekly for the next 24 weeks following GBR: weeks 1, 2, 8, 12, 16, 18, and 20.

Inclusion Criteria: Age at least 20 years, the opposing dentition is natural teeth, fixed crowns on natural teeth, or bridges on natural teeth, the subject has one missing maxillary or mandibular posterior tooth that necessitates an alveolar bone replacement procedure before a dental implant can be placed and no removable prostheses or dentures are allowed.

RESULTS

CD61LIN SB cells purification: 40 ml of blood was collected and placed in four tubes of EDTA. The blood samples were separated into two layers 48–72 hours after they were acquired. After the top layer was removed, the SB mixture was pipetted into a 50 ml tube and centrifuged for 15 minutes and then washed with 10 ml DPBS before being transferred into 15mm tubes for extraction. To eliminate mature hematopoietic cells from the SB mixture, we employed a Miltenyi Biotech human lineage depletion kit, and anti-CD61 antibody-coated micro beads were used to remove CD61+ cells. Cell size and the Lgr5+ population in CD61Lin SB cells were measured using flow cytometry on CD61Lin SB cells. The CD61Lin SB cell product was evaluated in accordance with the following criteria:

- The tests for mycoplasma and fungal sterility And tests for cell viability, endotoxin, and Lgr5+ cell counts, all came out negative.
- 80% of the cells were viable, and cell numbers were <2.5%.
- The diameter of the cells 2 and 5 mm.
- The CD61Lin SB cell product was diluted in 0.25 ml of DPBS. After the SB cells were injected, an absorbable double-layer collagen membrane was utilized to cover the wound. An entire thickness flap was created on the surgical site under local anesthesia. The GBR collagen complex was applied. A second treatment was performed following the removal of the granulation tissue. SB cells and hydroxylapatite powder were used to fill the alveolar bone defects, and repeated a third time. It was necessary to stitch the area around the wound after the absorbable collagen membrane had been applied. The Osseotite® acid-etched implants were placed 12 weeks following the GBR operation. To compare the overall responses of the three dose groups, one-way ANOVA and Tukey's post hoc analysis were employed in conjunction with each other. SPSS version 25 was used.

<table>
<thead>
<tr>
<th>#</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>64</td>
<td>72</td>
<td>44</td>
<td>29</td>
<td>54</td>
<td>57</td>
<td>80</td>
<td>49</td>
<td>45</td>
<td>60</td>
<td>68</td>
<td>59</td>
<td>70</td>
<td>53</td>
<td>48</td>
</tr>
<tr>
<td>Sex</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Dose (CD61-lin SB cells)</td>
<td>Low (1x10^5)</td>
<td>Low (1x10^5)</td>
<td>Low (1x10^5)</td>
<td>Low (1x10^5)</td>
<td>Medium (1x10^5)</td>
<td>Medium (1x10^5)</td>
<td>Medium (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
<td>High (1x10^5)</td>
</tr>
<tr>
<td>Missing teeth</td>
<td>15</td>
<td>14</td>
<td>47</td>
<td>35</td>
<td>46</td>
<td>26</td>
<td>37</td>
<td>36</td>
<td>36</td>
<td>46</td>
<td>35</td>
<td>16</td>
<td>15</td>
<td>47</td>
<td>34</td>
</tr>
</tbody>
</table>

Received on 14-07-2021
Accepted on 23-12-2021
DISCUSSION

According to the findings, all the patients had good outcomes. Counting down from one to four, the success of dental implants in osseointegration is reliant on a variety of parameters. A substantial influence is played by both trabecular bone density and cortical bone density when it comes to promoting bone regeneration and implant durability. As a result, measures of bone mineral density and maximum stress may be able to capture some of the treatment-induced changes in bone quality and quantity. The larger mean trabecular non-cortical bone density, also known as the D2–D3 level of bone density, was assessed in this study to determine whether or not the posterior mandible possessed this level of bone density. Implant patients were assigned density levels in the D3 range, which is relevant because higher density levels have been linked to worse implant success rates in the past. Adding more research, such as a biopsy of the cortical bone thickness or an evaluation of the microarchitecture of trabecular bones, could have improved the conclusions of the study.

Following the completion of this experiment, it was discovered that SB cells were safe and acceptable in patients with significant bone abnormalities. Furthermore, SB cells appeared to have speeded up the process of tooth repair. SB cells have the potential to stimulate bone regeneration.

Conflict of interest: Mil

REFERENCES